EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Gary Pitzer (Reg. # 39334) on Friday September 10th, 2009.

The application has been amended as follows.

Replace the prior listing of claims with this listing of claims:

1-2. (Canceled).

3. (Previously presented): A multi-processor system comprising:

an owner predictor control that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data, the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data;

wherein a given one of the plurality of owner predictors, associated with a processor, comprises a first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component that stores ownership update messages provided from the owner predictor control; and

a requesting node that provides a first request for the block of data to a home node, the requesting node being operative to provide a second request for the block of data to at least one predicted node in parallel with first request, the at least one predicted node being selected by an associated one of the plurality of owner predictors.

4. (Original): The system of claim 3, wherein the requesting node receives a coherent copy of the block of data from at least one of the home node and the at least one predicted node, the requesting node consuming a first coherent copy of the block of data received.

5. (Original): The system of claim 3, wherein a cached copy of the block of data exists at the owner node, the home node issuing a third request for the block of data to the owner node.

6. (Original): The system of claim 5, wherein the system employs a directory-based cache coherency protocol, the home node further comprising a directory that maintains directory state information associated with the block of data, the home node issuing the third request to the owner node based on the directory state information indicating that the owner node has an exclusive cached copy of the block of data.

7. (Original): The system of claim 5, wherein the owner node provides one of (i) a response to the home node and (ii) a response to the home node and to the requesting node, the owner node providing the response based on a state of the cached copy of the block of data at the owner node.

8. (Original): The system of claim 5, wherein the at least one predicted node comprises the owner node, the owner node having an exclusive cached copy of the block of data and providing a data response to the requesting node based on which of the second request and the third request arrives at the owner node first.

9-12. (Canceled)

13. (Currently Amended): A multi-processor network comprising:

a first processor that includes a cache having a plurality of cache lines associated with respective blocks of data, one cache line in the cache of the first processor transitioning to an ownership state based on a response to a request provided by the first processor;

a second processor that includes an associated owner predictor;

an owner predictor control that broadcasts an update message to respective owner predictors associated with each of a plurality of processors comprising the multiprocessor network, including the owner predictor associated with the second

processor to identify ownership for the one cache line consistent with the one cache line transitioning to the ownership state,

wherein the second processor provides a first request for data to the home node and a second request in parallel with the first request for the data at least one predicted node identified by the owner predictor.

14-15. (canceled)

16. (Previously Presented): A multi-processor network comprising:

a first processor that includes a cache having a plurality of cache lines associated with respective blocks of data, one cache line in the cache of the first processor transitioning to an ownership state based on a response to a request provided by the first processor;

a second processor that includes an associated owner predictor;

an owner predictor control that broadcasts an update message to respectively owner predictors associated with each of a plurality of processors comprising the multiprocessor network, including the owner predictor associated with the second processor to identify ownership for the one cache line consistent with the one cache line transitioning to the ownership state,

wherein the owner predictor control monitors available bandwidth in the network and provides the update message based on the available bandwidth relative to a threshold value.

17. (Original): The network of claim 13, the network further comprising a home node having a directory that includes directory state information associated with the plurality of cache lines, the directory state information being updated to reflect the one cache line transitioning to the ownership state, and the owner predictor control providing an update message in response to the updating of the directory state information.

18 (Cancelled)

19. (Currently Amended): The network of [[claim 18]] claim 13, wherein the at least one predicted node comprises the first processor based on the update message.

20. (Original): The network of claim 17, further comprising an unordered network interconnect that enables communication of requests, responses, and update messages among at least the first processor, the second processor and the home node.

21. (Previously Presented): A system comprising:

a requesting node that provides a first request for a block of data to a home node, the requesting node being operative to provide a second request for the block of data to at least one predicted node substantially in parallel with first request, the

requesting node receiving at least one coherent copy of the block of data from at least one of the home node and the at least one predicted node;

an owner predictor associated with each of a plurality of processor nodes that form the system, the owner predictor of the requesting node programmed to identify the at least one predicted node for servicing the first request; and

an update control that provides an ownership update message to the owner predictor associated with each of the plurality of processor nodes in response to a detecting a change in an ownership state for the block of data, the update message comprising an address tag associated with the block of data and a processor identification associated with an owner node of the block of data.

22. (Original): The system of claim 21, wherein the at least one coherent copy of the block of data is returned to the requesting node as a response in a response channel, the response being provided by the at least one predicted node.

23. (Original): The system of claim 21, wherein the home node provides a third request for the data to an owner node if the owner node has an exclusive cached copy of the requested data.

24. (Previously Presented): A system comprising:

a requesting node that provides a first request for a block of data to a home node, the requesting node being operative to provide a second request for the block of

data to at least one predicted node substantially in parallel with first request, the requesting node receiving at least one coherent copy of the block of data from at least one of the home node and the at least one predicted node;

an owner predictor associated with each of a plurality of processor nodes that form the system, the owner predictor of the requesting node programmed to identify the at least one predicted node for servicing the first request; and

an update control that provides an ownership update message to the owner predictor associated with each of the plurality of processor nodes in response to a detecting a change in an ownership state for the block of data, the update message comprising an address tag associated with the block of data and a processor identification associated with an owner node of the block of data,

wherein the home node provides a third request for the data to an owner node if the owner node has an exclusive cached copy of the requested data, and

wherein the first request is provided in a request channel, and the second and third requests are each provided in a forward channel.

25. (Canceled)

26. (Previously Presented): The system of claim 23, wherein the at least one predicted node comprises the owner node, the owner node providing a data response to the requesting node in response to which of the second request and the third request that arrives at the owner node first.

27. (Original): The system of claim 26, wherein the owner node provides a victim message to the home node and the data response to the requesting node in response to the third request arriving at the owner node prior to the second request, the home node providing a speculation acknowledgement to the requesting node in response to the victim message from the owner node.

28. (Previously Presented): The system of claim 26, wherein the owner node provides a victim message to the home node in response to the second request arriving at the owner node prior to the third request, the owner node also providing the data response to the requesting node in response to the second request from the requesting node.

29. (Original): The system of claim 21, wherein the at least one predicted node further comprises a target node having a cache that includes the data having one of an invalid state and a shared state, the at least one predicted node providing a miss response to the requesting node in response to the second request, and the owner node providing a data response to the requesting node in response to the third request.

30. (Currently Amended): A multi-processor system comprising:

means for identifying a predicted owner node associated with a block of data, a respective one of the means for identifying being associated with each of a plurality of nodes in the multi -processor system, including a requesting node;

means for selectively providing a first request for the block of data from the requesting node to the predicted owner node; [[and]]

means for broadcasting updates to all the means for identifying in response to a change in ownership of the block of data, the means for updating being remote from the means for identifying;

means for providing a second request for the block of data from the requesting node to a home node, the second request being provided substantially in parallel with the first request; and

means for providing a coherent copy of the block of data to the requesting node in response to at least one of the first request and the second request.

31. (Cancelled):

32. (Currently Amended): The system of [[claim 31]] claim 30, further comprising:

means for ascertaining whether the predicted owner node has an exclusive cached copy of the block of data; and

means for providing a third request for the block of data from the home node to an owner node when the predicted owner node has the exclusive cached copy of the block of data.

33. (Original): The system of claim 30, wherein the means for updating comprises means for determining a frequency with which the block of data has changed ownership over a period of time, the means for updating being operative to update the means for identifying for a the block of data based on the determined frequency relative to a threshold frequency.

34. (Canceled)

35. (Previously Presented) A method comprising:

updating ownership state information for a block of data at a plurality of owner predictors associated with respective processors that form a multi-processor system based at least in part on a change in the ownership state information of the block of data;

identifying at least one of the processors as a predicted owner node based on the updated ownership state information in a given one of the plurality of owner predictor associated with a respective processor;

issuing a first request for the block of data from a requester to a home node;

concurrently issuing a second request for the block of data from the requester to the predicted owner node based on the updated ownership state information; and

receiving at least one coherent copy of the block of data at the requester from an owner processor, if the owner processor has an exclusive cached copy of the block of data, and from the home node, if no exclusive cached copy of the block of data exists when the home node receives the first request.

36. (Original): The method of claim 35, further comprising issuing a third request for the block data from the home node to the owner processor in response to determining that the owner processor has the exclusive cached copy of the block of data.

37. (Original): The method of claim 36, further comprising providing the at least one coherent copy of the block of data in response to the second request when owner processor receives the second request prior to the third request.

38. (Original): The method of claim 36, further comprising providing the coherent copy of the block of data in response to the third request when owner processor receives the third request prior to the second request.

39. (Previously Presented) A multi-processor system comprising:

an owner predictor control that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data, the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data;

wherein a given one of the plurality of owner predictors, associated with a processor, comprises a first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor and a second component that stores ownership update messages provided from the owner predictor control, and

wherein the owner predictor control is configured to discontinue providing the ownership update message corresponding to a given block of data based on (i) an available bandwidth in the system, and (ii) a frequency with which the given block of data changes ownership.

40. (Currently Amended): A multi-processor system comprising:

an owner predictor control that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data, the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data;

wherein a given one of the plurality of owner predictors, associated with a processor, comprises a first component that predicts an owner node of the block of data

by observing the pattern of instructions within the processor and a second component that stores ownership update messages provided from the owner predictor control, [[and]]

wherein the owner predictor control is programmed to broadcast the ownership update message to each of the plurality of owner predictors to indicate the change in the ownership state of the block of data; and

wherein the owner predictor control is configured to discontinue broadcasting the update message corresponding to a given cache line based on (i) an available bandwidth in the system, and (ii) a frequency with which the given block of data changes ownership.

41. (Cancelled)

Allowable Subject Matter

The following is an examiner's statement of reasons for allowance:

Claims 3-8, 13, 16-17, 19-24, 26-30, 32-33, and 35-40 are allowed.

The claimed invention is drawn to a multi-processor system comprising an owner predictor control providing an ownership message for a block of data to a plurality of owner predictors in response to a change in ownership state of the block of data.

Each of the owner predictors is associated with a processor and comprises a component that predicts an owner node for the block of data by observing the pattern of

instructions within the processor and a component that stores ownership update messages from the owner predictor control.

The multi-processor system comprises a requesting node that provides a first request for the block of data to a home node and a second request for the block of data to a predicted node in parallel with the first request wherein the predicted node is selected by an owner predictor.

The claimed invention is also drawn to the owner predictor control discontinuing the ownership update messages corresponding to a given block of data based on and available bandwidth in the system, and a frequency with which the given block of data changes ownership.

The Prior Art of Record teaches (Martin et al. US 2002/0133674 A1) discloses a multi-processor system (shown in Figure 1) comprising:

an owner predictor control (par. 0043, cache controller 26 comprising predictor 98 of Fig 8) that provides an ownership update message corresponding to a block of data to at least one of a plurality of owner predictors in response to a change in an ownership state of the block of data (cache coherency message requesting a block of data is received by each processor unit 12, each processor unit evaluates if it has the requested block of data in their cache memory, depending on the type of request, each processor unit changes its ownership status for that block of data and provides the requested block to the requestor, wherein providing the requested block the processor unit is updating the ownership status of the block since the requestor may acquire

ownership or shared status of the block, see par. 0060 and the status is updated in the directory, par. 0061. Therefore, the message that provides the requested block of data to the requestor represents the ownership update message), the update message comprising an address tag associated with the block of data and an identification associated with an owner node of the block of data (a response to a request for data, in the form of providing the requested block to the requestor, must include an identification of the block requested and the node of the requestor); and

wherein a given one of the plurality of owner predictors, associated with a processor (par. 0043, cache controller 26 comprising predictor 98 of Fig 8 which is part of each of the plurality of processor units 12, ash shown in Fig. 1), comprises a first component that predicts an owner node of the block of data by observing the pattern of instructions within the processor (function of predictor 98) and a second component that stores ownership update messages provided from the owner predictor control (par. 0071, the predictor 98 which is part of cache controller 26 of Martin makes predictions by **storing** and evaluating information about mispredictions of the same or spatially adjacent blocks of data, mispredictions of the same static load or store instructions, or input from software);

wherein the owner predictor control provides an ownership update message when the block of data at the owner node transitions to one of a modified or exclusive state (multicast due to request, thus the block will be accessed, thus modified or exclusive state, par. 0005).

The Prior Art of Record does not teach a requesting node that provides a first request for the block of data to a home node, the requesting node being operative to provide a second request for the block of data to at least one predicted node in parallel with the first request the at least one predicted node being selected by an associated one of the plurality of owner predictors.

The Prior Art of Record also does not teach the owner predictor control discontinuing the ownership update messages corresponding to a given block of data based on and available bandwidth in the system, and a frequency with which the given block of data changes ownership.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Midys Rojas whose telephone number is (571)272-4207. The examiner can normally be reached on M-TH 6:00am - 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Sanjiv Shah can be reached on (571) 272-4098. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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